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THE EXTENSION BULLETIN

Issued Monthly by the Department of Agricultural
Extension of The Pennsylvania State College

Application for admission to second class matter pending.

Vol. I

OCTOBER, 1913

No. 1

In presenting this first issue of The Extension Bulletin, it is desired to state the reasons for launching such a publication, to outline its policy, and to give it proper setting in relation to the other activities of the College.

THE PENNSYLVANIA STATE COLLEGE.

Of the hundreds of measures enacted by each session of Congress, a few stand out as more vitally affecting the welfare of the nation, as a whole, than others. The so-called "Land Grant Act" of July 2, 1862, is one of these. By this act there was laid the foundation for the establishment of a so-called "Land Grant College" in each state of the Union. The scope of these institutions is comprehensively described in the act in these words: "The leading object shall be, without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the Legislatures of the states may prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life." This grant was accepted by the Pennsylvania Legislature in 1863 and the faith of the state pledged to carry it into effect. The Pennsylvania State College is the institution in the Keystone State which has been established upon this broad foundation.

Organization. The organization of the Institution consists of five great schools, including agriculture, engineering, mining, natural science and liberal arts, as well as a department of home economics. A plant whose value exceeds \$2,000,000 has been developed. The number of students has increased from 433 in 1910-11 to 1976, the en-

rollment in the year 1912-13. This present number is distributed among the several schools as follows:

School of Agriculture.....	851*
School of Engineering.....	754
School of Liberal Arts.....	64
School of Mines.....	99
School of Natural Science.....	164
Department of Home Economics.....	44

In addition to the four years' course, the School of Agriculture offers a very practical two years' course, (in which 195 students were enrolled during the past year), as well as a twelve weeks' course and correspondence courses.

SCHOOL OF AGRICULTURE AND EXPERIMENT STATION.

Of the thirty-two four years' courses offered by the College, nine are given by the School of Agriculture. These are as follows: Agronomy, Animal Husbandry, Agricultural Chemistry, Agricultural Education, Botany, Dairy Husbandry, Forestry, Horticulture and Landscape Gardening. Five years ago, a few more than fifty students were pursuing courses in agriculture which required their presence throughout the college year. During the present year, as already indicated, there are about 851 students enrolled in these courses.

The Experiment Station. Following the passage of the Act establishing institutions for the teaching of young men and women, it was recognized that there should be an institution in each state engaged in research work to develop the underlying principles of agriculture which should form the basis for instruction and have a practical application to farm practice. In 1888, the Hatch Act was passed by Congress establishing an experiment station in every state of the Union, and almost without exception these have been correlated with the Land Grant Colleges.

The facts which have been developed by the Experiment Stations within the last three decades are having a powerful influence in reshaping the agriculture of the country.

Equipment. *Agronomy.*—The college owns and controls 1,074 acres of land, about 850 of which are under cultivation. Few colleges have an area equal to this. Both experimental and practical farming are carried on. The results of experiments are therefore co-ordinated with farm practice. Among the projects, which stand out prominently as supplying data having a direct bearing upon the farming of

*Includes two years' course students.

the state, may be mentioned the general fertilizer experiment, variety tests of farm crops, the treatment of grass lands and pastures, the effect of lime, and the value of different rotations for the improvement of worn out land; the growing of alfalfa, plant-breeding, tobacco investigations, a soil survey of the state, with a study of the adaptations and needs of different soil types.

Live Stock.—The College and Station has the most varied and extensive equipment of live stock belonging to any institution in the North Atlantic States. It ranks fifth in the United States, except in respect to horses. Pure-bred breeding herds of Shorthorn and Aberdeen-Angus cattle, as well as representatives of Galloway and Hereford breeds, are maintained. Flocks of Shropshire and Merino sheep for breeding, in addition to representatives of other breeds, are included in the live stock equipment. Berkshire, Duroc Jersey, Chester White, Tamworth and Yorkshire swine are kept. Flocks of poultry, representative of the leading breeds, are maintained.

Dairying.—The institution has one of the best constructed and equipped dairy buildings in the United States. A herd of seventy-five Guernsey cows, some of which are pure-bred, provide the basis for experimental work in feeding and for student work in judging. A few representatives of other dairy breeds, including Ayrshire, Jersey and Holstein are kept. The instruction and the experiments in farm dairy and commercial creamery work are so extensive that much more milk is required than can be produced by the College herd. A commercial creamery is therefore maintained.

Horticulture.—The thirty acres of apple orchard on the College farm, together with co-operative experiments in twelve orchards throughout the state, constitute the most extensive inquiry into causes affecting yield and quality of apples. Through proper fertilization alone, yields have been increased over 100%.

Pioneer work has been done in the standardization of the lime-sulphur spray and a comprehensive bulletin has been issued upon the control of insects and diseases affecting horticultural crops.

Extensive investigations are being conducted with cabbage, asparagus and tomatoes.

Animal Nutrition.—The Respiration Calorimeter is a piece of apparatus designed to determine the energy-producing value of feeds offered to the animal in the same manner in which the analysis of coal may indicate its value for producing heat or energy when burned under the boiler. This work is purely scientific in character and

is without parallel in the world. It is doing more to revolutionize the theory of feeding than any other single agency.

In addition to these main lines of work, the other departments of the Institution, including botany, experimental agricultural chemistry and forestry, are engaged in endeavoring to solve important problems which fall within their respective spheres.

Agricultural Extension.—The College recognizes that as a public institution it has a duty to perform outside of its own walls. The facts which the Experiment Station has developed must be made to serve the people. The work of the School of Agriculture and Experiment Station is three-fold: instructional work, experimental work and the carrying of the results of research work to the farmers of the state, in order that this work may be made practically helpful. Departments of Agricultural Extension have therefore been established in practically all of the Agricultural Colleges of the country. This Department is the link which connects the farmer with his Experiment Station, the only scientific institution of the kind in the state. It is intended to serve all the people and will gladly render assistance in so far as the number of men and amount of funds at its command will permit.

Research bulletins, giving detailed results of experiments, are published periodically. This publication does not take the place of research bulletins but will be used briefly to outline the salient facts concerning many problems upon which assistance is sought. It will also be made to serve as a means of giving wider publicity to many of the activities and interests of the School of Agriculture in which there is a general desire for information.

We ask the cordial co-operation of every one in any way interested in the agriculture of Pennsylvania.

ANNOUNCEMENTS.

The Winter Courses in Agriculture begin December 3, 1913, and end February 27, 1914. Anyone interested in securing larger returns from the farm should consider the possibilities these courses offer. For further information write for bulletin.

If you are interested in any branch of farming, FARMERS' WEEK, December 28 to January 3, offers an excellent opportunity to spend a few days at the College and will be helpful in solving some of your farm problems. A later issue of The Extension Bulletin will contain a full copy of the program.

Address all inquiries to Department Agricultural Extension, State College, Pa.

THE EXTENSION BULLETIN

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Vol. I

NOVEMBER, 1913

No. 2

FARMERS' WEEK NUMBER

Farmers' Week at The Pennsylvania State College was established in 1905. It is an effort to place the facilities of the institution at the service of all the farmers of the state so that they may have actual school advantages for a week. In order to care for the large number of visitors, it is necessary to hold it during the holiday vacation when the regular students are away from the College.

If you are interested in any branch of farming or farm life, plan to spend the week, **December 29, 1913, to January 3, 1914**, at the College. It will pay you.

Form a Farmers' Week Club among your neighbors and attend in a body. The courses are free and are open to women as well as men.

The Department of Home Economics will conduct a section throughout the week, which should offer special attraction to women.

Ample accommodations may be found in the village at from \$1.00 to \$2.00 per day.

Railroad Rates. One and three-fifths fare for the round trip will be offered by all trunk line railroads. For information inquire of your local station agent.

Routes. Those coming from the south and west via the Pennsylvania Railroad change at Tyrone for Bellefonte; from the north via the Pennsylvania Railroad, change at Lock Haven, and via the Beech Creek change at Mill Hall for Bellefonte; from the east via the Pennsylvania Railroad, change at Montandon for Lemont (State College). Trains leave Bellefonte for State College at 6:30 and 10:15 A. M. and 2:00 P. M.

ANNOUNCEMENTS

The Registration and Information Office will be found in the Agricultural Building. All persons should register immediately upon arrival.

Where more than one lecture is scheduled for a period, except in the evening, such lectures will be given simultaneously. The locations and numbers of the rooms in which the several lectures will be given are shown with each subject listed.

Ag. is abbreviation for Agricultural Building; Hort. for Horticultural Building, and Dairy for Dairy Building. • Rooms numbered 1 to 99 are in the basement; 100 to 200 on the first floor and 200 to 300 on the second floor of the several buildings.

Evening lectures will be given in the Auditorium.

Practice in apple packing every day during the week from 8:30 to 11:45 A. M. and from 2:00 to 5:15 P. M. (Hort. 2).

Practice in judging corn December 20th to January 2nd, both inclusive, from 2:00 to 3:30 P. M. This should be especially attractive to the boys. (Third floor, Agricultural Building.)

Practice in figuring fertilizer formulas, December 31 to January 2, both inclusive, from 10:15 to 11:45 A. M. (Ag. 207.)

LIST OF SPEAKERS

E. L. Anthony: Instructor in Dairy Husbandry.
 H. P. Armsby: Director of the Institute of Animal Nutrition.
 E. N. Bates: Instructor in Mechanical Engineering.
 J. R. Bechtel: Assistant in Horticulture.
 R. H. Bell: Assistant in Experimental Pomology.
 E. W. Benjamin: Instructor in Poultry Husbandry, Cornell University.
 I. J. Bibby: Assistant in Dairy Husbandry.
 M. A. Blake: Horticulturist, New Jersey Experiment Station.
 R. U. Blasingame: Instructor in Agronomy.
 U. Grant Border: Baltimore, Maryland.
 Andrew Boss: Professor of Farm Management, University of Minnesota.
 Miss Elizabeth Bower: Instructor in Chemistry and Domestic Science.
 A. W. Cowell: Assistant Professor of Horticulture.
 W. H. Darst: Assistant Professor of Agronomy.
 H. P. Davis: Assistant in Experimental Dairy Husbandry.
 G. E. Day: Professor of Animal Husbandry, Ontario Agricultural College, Guelph, Canada.
 B. W. Dedrick: Instructor in Milling Engineering.
 E. H. Dusham: Instructor in Zoology.
 G. F. Eckhard: Assistant Professor of Structural Engineering.
 F. N. Fagan: Assistant Professor of Horticulture.
 J. A. Ferguson: Professor of Forestry.
 William Frear: Professor of Experimental Agricultural Chemistry.
 F. D. Gardner: Professor of Agronomy.
 R. H. Garrahan: Market Gardener, Kingston, Pa.
 C. W. Gay: Professor of Animal Husbandry, University of Pennsylvania.
 Paul Gerlaugh: Assistant in Animal Husbandry.
 G. C. Given: Assistant Professor of Experimental Agricultural Chemistry.
 C. L. Goodling: Superintendent of Farms.
 W. R. Gorham: Agricultural Extension.
 J. D. Harlan: Assistant in Experimental Agronomy.
 H. H. Havner: Assistant Professor of Animal Husbandry.
 Miss Harriet B. Hecker: Instructor in Institutional Management.
 E. K. Hibshman: Agricultural Extension.
 C. W. Hickman: Assistant in Animal Husbandry.
 A. F. Hildebrandt: Gardener.
 Arthur Holmes: Dean of the General Faculty.
 H. W. Jeffers: Walker-Gordon Farms, Plainsboro, N. J.
 F. D. Kern: Professor of Botany.
 M. C. Kilpatrick: Instructor in Animal Husbandry.
 H. R. Kraybill: Field Assistant in Experimental Agricultural Chemistry.
 C. W. Larson: Professor of Dairy Husbandry.
 Miss Margaret B. Lawsing: Instructor in Industrial Art.
 H. R. Lewis: Poultry Husbandman, New Jersey Experiment Station.
 Miss Sara C. Lovejoy: Dean of Women.
 T. I. Mairs: Professor of Agricultural Education.
 C. J. Marshall: State Veterinarian, Harrisburg, Pa.
 M. S. McDowell: Agricultural Extension.
 C. E. Myers: Associate in Horticulture.
 W. B. Nissley: Instructor in Horticulture.
 C. F. Noll: Assistant Professor of Experimental Agronomy.
 Otto Olsen: U. S. Department of Agriculture, Washington, D. C.
 C. R. Orton: Assistant Professor of Botany.
 Miss Anne C. Perry: Instructor in Domestic Science.
 F. S. Putney: Assistant Professor of Dairy Husbandry.
 Robert Pyle: Florist, West Grove, Pa.
 J. A. Runk: Instructor in Horticulture.
 B. O. Severson: Assistant Professor of Animal Husbandry.
 Edwin E. Sparks: President of The Pennsylvania State College.
 J. P. Stewart: Professor of Experimental Pomology.
 C. W. Stoddart: Professor of Agricultural Chemistry.
 C. E. Thorne: Director of the Ohio Experiment Station, Wooster, Ohio.
 W. H. Tomhave: Professor of Animal Husbandry.
 L. C. Tompkins: Agricultural Extension.
 C. J. Tyson: Orchardist, Flora Dale, Pa.
 D. E. Warner: Assistant in Poultry Husbandry.
 R. L. Watts: Dean and Director, School of Agriculture and Experiment Station.
 J. W. White: Associate in Agronomy.
 E. I. Wilde: Instructor in Horticulture.
 Paul Work: Department of Vegetable Gardening, Cornell University.
 E. L. Worthen: Assistant Professor of Agronomy.

Monday, December 29th,

8:30 to 12:00 Noon.

Registration

11:00 A. M.

Greeting (Ag. 109).....R. L. Watts

2:00 to 3:30 P. M.

The Meaning of Soil Analysis (Ag. 211).....	J. W. White
Demonstration with Fat Cattle (Ag. 5).....	W. H. Tomhave
Judging Dairy Cows (Dairy Barn).....	E. L. Anthony
Experiments with Peaches (Hort. 3).....	M. A. Blake
Diseases of the Brambles (Ag. 103).....	C. R. Orton
Rearing Chickens (Ag. 109).....	M. C. Kilpatrick

3:45 to 5:15 P. M.

Legumes for Pennsylvania (Old Chapel).....	{ F. D. Gardner J. D. Harlan W. H. Darst
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7:30 P. M.

A Word of Welcome.....Edwin E. Sparks
Some Views of Rose Growing.....Robert Pyle
Some Effects of Weather upon Tree Fruits.....M. A. Blake

Tuesday, December 30th,

8:30 to 10:00 A. M.

Phosphatic Fertilizers (Ag. 211).....	M. S. McDowell
Pork Production (Ag. 206).....	H. H. Havner
Cow Testing Associations (Dairy 259).....	L. C. Tompkins
Protecting the Fruit Plantation from Frost (Hort. 3).....	J. A. Runk
Plant Diseases Affecting Cucumbers and Allied Plants (Ag. 207) ..	F. D. Kern
Green-house Construction and Heating (Hort. 4).....	E. I. Wilde
The Production of Pennsylvania Tobacco (Ag. 103).....	E. K. Hibshman
Marketing Poultry Products (Ag. 109).....	E. W. Benjamin

10:15 to 11:45 A. M.

Soils of Pennsylvania and Their Adaptation (Ag. 109).....	E. L. Worthen
Maintaining a Beef Breeding Herd in Pennsylvania (Ag. 207) ..	B. O. Severson
Dairy Herd Management (Dairy 259)	H. W. Jeffers
Preparation and Use of Lime Sulphur (Ag. 206)	J. P. Stewart
The Value of Hot Beds and Cold Frames on the Farm (Hort. 3) ..	W. B. Nissley
The Forcing of Holiday Stock—with demonstration (Botany Bldg.)	A. F. Hildebrandt
The Arithmetic of Fertilizers (Ag. 211)	G. C. Given
Improving the Farm Flock (Ag. 103)	M. C. Kilpatrick

2:00 to 3:30 P. M.

Increasing Water Holding Capacity of Soils (Ag. 211).....	E. L. Worthen
Opportunities in Swine Breeding (Ag. 206).....	G. E. Day
Selecting a Dairy Sire (Dairy Barn).....	F. S. Putney
Cultural Methods and Results in Apple Orchards (Ag. 109)....	J. P. Stewart
Insects Affecting Beans and Peas (Ag. 207).....	E. H. Dusham
Rose Culture Under Glass and in the Field (Hort. 4).....	Robert Pyle
Tobacco Investigations in Pennsylvania (Ag. 103).....	Wm. Frear
Improving Quality in Market Eggs (Hort. 3).....	E. W. Benjamin

3:45 to 5:15 P. M.

Cost of Producing Farm Products (Old Chapel).....	Andrew Boss
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7:30 P. M.

Some of Our Activities.....	R. L. Watts
The County Agent in Pennsylvania.....	E. K. Hibshman
Making the Experiment Station Effective.....	M. S. McDowell

Wednesday, December 31st,

8:30 to 10:00 A. M.

Corn Improvement (Ag. 211).....	W. H. Darst
Live Stock and Soil Fertility (Ag. 109).....	Andrew Boss
Feeding Dairy Cows (Dairy 259).....	F. S. Putney
Commercial Peach Growing (Ag. 206).....	R. H. Bell
Some Principles in Breeding Cabbage and Tomato Seed (Hort. 3)	C. E. Myers
Seed Beds and Tobacco Insects (Ag. 103).....	{ Otto Olsen H. R. Kraybill
Killing and Dressing Poultry for Market—demonstration (Ag. 5)	D. E. Warner
Food for the Farmer's Family—lecture and demonstration (Woman's Bldg.).....	Anne C. Perry

10:15 to 11:45 A. M.

Results of Fertilizer Experiments (Ag. 109).....	F. D. Gardner
Feeding and Management of the Brood Sow and Litter (Ag. 206) ..	G. E. Day
Handling Labor on a Dairy Farm (Dairy 259).....	H. W. Jeffers
Fertilizer Work in Apple Orchards (Hort. 3).....	J. P. Stewart
Plant Diseases Affecting Tomatoes (Ag. 103).....	C. R. Orton
Planting and Adorning the Farmstead (Hort. 4).....	A. W. Cowell
Fattening Poultry (Ag. 211).....	M. C. Kilpatrick
Farm Engines, Their Care and Operation—with demonstration (Engineering Bldg. 202).....	E. N. Bates

2:00 to 3:30 P. M.

Potato Culture (Ag. 109).....	C. F. Noll
Judging Breeding Hogs (Dairy Barn).....	Paul Gerlaugh
Opportunities for Sheep Growing in Pennsylvania (Ag. 211) ..	B. O. Severson
Testing Milk (Dairy 259).....	C. W. Larson

Fruit from the Commission Man's Standpoint (Ag. 206) . . . U. Grant Border
 Tomato Growing for Market (Hort. 3) C. E. Myers
 Culture of the American Carnation (Hort. 4) E. I. Wilde
 Grading Market Eggs—demonstration (Ag. 5) D. E. Warner
 Simplifying Modern Housekeeping (Woman's Bldg.) Sara C. Lovejoy

3:45 to 5:15 P. M.

Importance and Methods of Improving Farm Crops (Old Chapel) { C. E. Myers
 C. F. Noll

7:30 P. M.

A Glimpse of European Agriculture F. S. Putney
 Farm Management Andrew Boss

Thursday, January 1st,

8:30 to 10:00 A. M.

Weeds and How to Eradicate Them (Ag. 109) W. H. Darst
 Methods of Steer Feeding (Ag. 206) W. H. Tomhave
 Balancing Dairy Rations (Dairy 259) F. S. Putney
 Insect Pests in the Apple Orchard (Hort. 3) J. P. Stewart
 Forcing House Problems (Ag. 103) J. R. Bechtel
 How Fertilizers Act (Ag. 211) C. W. Stoddart
 Candling Eggs for Market—demonstration (Ag. 5) D. E. Warner
 Food for the Farmer's Family—lecture and demonstra- { Anne C. Perry
 tion (Woman's Bldg.) { Harriet B. Hecker
 Concrete on the Farm (Engineering Bldg. 202) G. F. Eckhard

10:15 to 11:45 A. M.

Land Drainage (Ag. 211) R. U. Blasingame
 The Importance of Pure Bred Live Stock (Ag. 109) Andrew Boss
 Dairy Barn Building (Dairy 259) C. W. Larson
 Building up the Old Apple Orchard (Ag. 206) C. J. Tyson
 Overhead Irrigation (Dairy 251) W. B. Nissley
 The 20th Century Chrysanthemum and Its Culture (Hort. 4) E. I. Wilde
 Energy Values of Feeding Stuffs (Ag. 103) H. P. Armsby
 Principles of Poultry House Construction (Hort. 3) H. R. Lewis

2:00 to 3:30 P. M.

Crop Rotations (Ag. 211) W. R. Gorham
 Control of Tuberculosis in Cattle (Ag. 206) C. J. Marshall
 Feeding Farm Horses (Ag. 103) H. H. Havner
 Testing for Moisture in Butter (Dairy 259) I. J. Bibby
 The Winter Fruit Storehouse (Ag. 207) F. N. Fagan
 Cooperation Among Vegetable Growers (Hort. 3) Paul Work
 Planting and Care of Shade Trees (Hort. 4) A. W. Cowell

Feeding for Egg Production (Ag. 109).....H. R. Lewis
The Welfare of the Child (Woman's Bldg.).....Elizabeth Bower

3:45 to 5:15 P. M.

Lime (Old Chapel).....C. E. Thorne

7:30 P. M.

Insect Pests of Farm Crops.....W. H. Darst
Principles of Cooperation.....W. H. Tomhave

Friday, January 2nd,

8:30 to 10:00 A. M.

Stable and Yard Manure (Old Chapel).....C. E. Thorne
Recent Legislation Concerning the Control of Live Stock Diseases (Ag. 206)
.....C. J. Marshall
Judging Dairy Heifers (Dairy Barn).....E. L. Anthony
Spray Outfits (Hort. 3).....R. H. Bell
Growing Early Vegetable Plants (Ag. 109).....R. H. Garrahan
Judging Poultry—Egg Type (Ag. 5).....D. E. Warner
Meat Substitutes in the Dietary—lecture and demonstra- {Anne C. Perry
tion (Woman's Bldg.)..... {Harriet B. Hecker

10:15 to 11:45 A. M.

Composition of Pennsylvania Limestones (Ag. 109).....Wm. Frear
Judging Breeding Cows (Dairy Barn).....C. W. Hickman
Developing a Dairy Herd (Dairy 259).....F. S. Putney
Picking and Preparing Apples for Market (Ag. 206).....C. J. Tyson
Important Factors in Asparagus Culture (Hort. 3).....R. L. Watts
General Stock for Summer Cut Flowers and for Bedding (Hort. 4) .E. I. Wilde
Cooperation of the Miller with the Farmer (Electrical Bldg. 24) .B. W. Dedrick
Farm Woodlots (Ag. 103).....J. A. Ferguson

2:00 to 3:30 P. M.

Farm Equipment (Ag. 109).....C. L. Goodling
Possibilities for Horse Breeding in Pennsylvania (Ag. 206).....C. W. Gay
Clean Milk Production (Dairy 259).....C. W. Larson
The Farmer's Orchard (Ag. 211).....F. N. Fagan
Marketing Vegetables (Hort. 3).....Paul Work
The Culture of Conservatory and House Plants (Botany Bldg.).....
.....A. F. Hildebrandt
Judging Poultry—General Purpose Type (Ag. 5).....D. E. Warner

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Vol. I

DECEMBER, 1913

No. 3

The Winter Course in Agriculture opened Dec. 3 and will continue twelve weeks. 176 students are enrolled in these courses.

1109 students are now taking work in the School of Agriculture. 710 of these are taking the four years' courses, 215 the two years' course, and the remainder are pursuing winter courses. The resources in the way of class rooms and laboratories are taxed to the limit to properly care for this work.

The total enrollment in the entire college is 2292.

The following table shows the distribution of students in the college:

School of Agriculture.....	1109
School of Engineering.....	771
School of Liberal Arts.....	98
School of Mines.....	88
School of Natural Science.....	180
Dept. of Home Economics.....	46

LIME

Experience teaches that some soils do not contain enough lime to permit the maximum production of crops. The area of these soils grows greater year by year. This is due in part to leaching. A deficiency in lime is not confined to soils outside of limestone belts, but may be found in soils originally rich in lime.

Crop yields are limited by any lack of lime. When this is the case, good farming requires that the lack be supplied. Some crops are affected by a low content of lime in the soil more quickly than others. Clover demands an abundance of lime. The tendency of

soils to lose their lime results finally in clover failure, and gives opportunity to sorrel, plantain and other worthless plants that can thrive with a lower percentage of lime in the soil.

In conducting the soil survey of Pennsylvania it was found that on all the soil formations in all parts of the state, there was much sour land.

Lime is the only available effective material for correcting soil acidity.

Carriers of Lime. Limestone is our chief source of lime. It consists chiefly of calcium carbonate, or what is more commonly known as carbonate of lime. When pure it contains 56 per cent. of actual lime. If limestone could be made absolutely fine, 1120 pounds out of every ton would be effective in making up the deficiency of lime in a soil.

When one ton of pure limestone is burned and the 44 pounds in every hundred which is not actual lime is driven off into the air, the 1120 pounds remaining is called stone lime. This is the ordinary lime on the market. When the farmer buys 1120 pounds of stone lime he has the same amount of actual lime as he would have obtained in the ton of raw limestone.

When stone lime is perfectly slaked with water, the weight is increased 32 per cent. This increased weight adds nothing to the actual lime, but makes even distribution over the ground possible. Slaked lime is sometimes called hydrated lime, and is put on the market by some manufacturers as "patent process" lime. It is more convenient for use than stone lime because it is slaked, and it has about three-fourths as much strength as the stone lime before weight was added by slaking. Manufacturers have equipment for hydrating that enables them to do the slaking more perfectly than it is ordinarily done on the farm, and they bag it so that handling is easy.

When stone lime or water-slaked lime stands exposed to the air, it finally takes from the air carbon dioxide, the material that was driven off by burning the limestone. It thus increases in weight until the 1120 pounds of stone lime which resulted from burning a ton of limestone, becomes 2000 pounds, and the material has the same composition as that of raw limestone. For use on land it has somewhat more value because it is finer than raw limestone can be made by mechanical means.

If the raw limestone can be made equally fine it would be just as good as the air-slaked lime for the same purpose. If used in generous amounts it need not be so fine as air-slaked lime, but in order to be prompt and effective, pulverized limestone should be so fine that a large percentage of it will pass through a 60-mesh screen. Where abundant and cheap larger amounts of coarser material may be used. No matter in what form lime is applied to the soil it soon reverts to its original form of carbonate of lime.

When stone lime is prepared for market, the lumps are forked out of the pile, and a remnant is left that may be about as pure as the stone lime, though it usually contains some impurities. This is called "agricultural lime," and its value depends upon its original purity and its freedom from any air-slaking which would add to its weight. The buyer must depend upon the statements of the seller respecting its quality.

We have given figures of relative values for pure limestone and lime. The value of lime in any form depends upon its purity and mechanical condition. It should be in such mechanical condition that it can be thoroughly distributed in the soil. The more calcium a given bulk or weight of lime contains, the more valuable it is. When the impurities in limestone do not exceed 10 per cent. the limestone and lime may be rated as pure.

Experiments with Lime. Experiments at the Pennsylvania State College show that finely pulverized raw limestone is just as prompt and effective in correcting soil acidity and promoting a growth of clover as equivalent amounts of caustic lime. Field tests show that pulverized raw limestone has given a slightly larger yield of crops than equivalent amounts of caustic lime. The lime and limestone seem to have been leached from the soil with about equal rapidity.

While these experiments seem to show that ground limestone has given a little better returns than the caustic lime, such returns are not sufficiently greater to justify the use of ground limestone at a disproportionate price. If two tons of ground limestone cost much more than one ton of burned lime, one would ordinarily not be justified in using the former.

In cases where lime must be shipped some distance the more concentrated forms are usually the cheaper. Experiments indicate that caustic lime may have a better effect upon the physical condition of heavy clay soils. Burned lime exhausts the humus in the soil more

rapidly than ground limestone. It is desirable that the use of lime or limestone lead to larger supplies of organic matter in the soil.

While there may be soils in Pennsylvania that would profit in higher degree from an application of pure lime than from an application of magnesian lime, our present knowledge does not permit us to discriminate against the magnesian lime for use on our farms. Magnesia acts in the soil in the same way as lime. Experiments in this and other states indicate that the magnesian lime has been effective and may be as good an investment as pure calcium lime.

Quantity per Acre. The amount of lime to apply depends on the degree of acidity of the soil and also on the character of the soil. If a soil is a tenacious clay, and physical improvement is desired, an application of two or three tons of stone lime may be profitable. Ordinarily lime is applied to correct acidity and make a soil friendly to clover and other plants and the equivalent of one to one and one-half tons of stone lime per acre, applied once in each crop rotation, is usually a maximum amount. In some instances 1000 pounds per acre will accomplish the desired result. The equivalent of 1000 pounds of stone lime is between 1300 and 1350 pounds of slaked (hydrated) lime, or a little less than one ton of raw limestone reduced to a powder.

Time of Application. An application of lime usually should pave the way for clover. It is well to apply lime a year or more before the seeding to clover. If this has not been done, it may be put on the land when the seed bed is being made for the wheat, oats or other crop with which clover is to be seeded.

Method of Applying. Lime should be applied after the ground is plowed and thoroughly mixed with the soil by harrowing or disking. The more thoroughly it is mixed with the soil the better and quicker will be the results. It should never be plowed under, because its tendency is to work downward. Do not drill lime in with seeds, nor mix it with commercial fertilizer, nor use it in place of fertilizer. Apply lime to meet the lime requirement of a soil, and when this has been done use manure and commercial fertilizers in the ways that have been found profitable for the crops which are to be grown, regardless of the fact that lime has been applied.